

Structure of Gastric Apex as a Subfamily Character of the Formicinae (Hymenoptera: Formicidae)

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Traditionally, the shape of the "cloacal orifice" in ants has been used as a taxonomic character to separate subfamilies Dolichoderinae and Formicinae. In Formicinae, the orifice is said to be circular, while in Dolichoderinae it is described as "slit-shaped." This nomenclature is as inexact as it is persistent. Despite a clarification by Emery (1922) and re-emphasis of Emery's findings by Buren (1944) and Brown (1954; also in key in Brues *et al*, 1954), most recent keys to the subfamilies preserve the error.

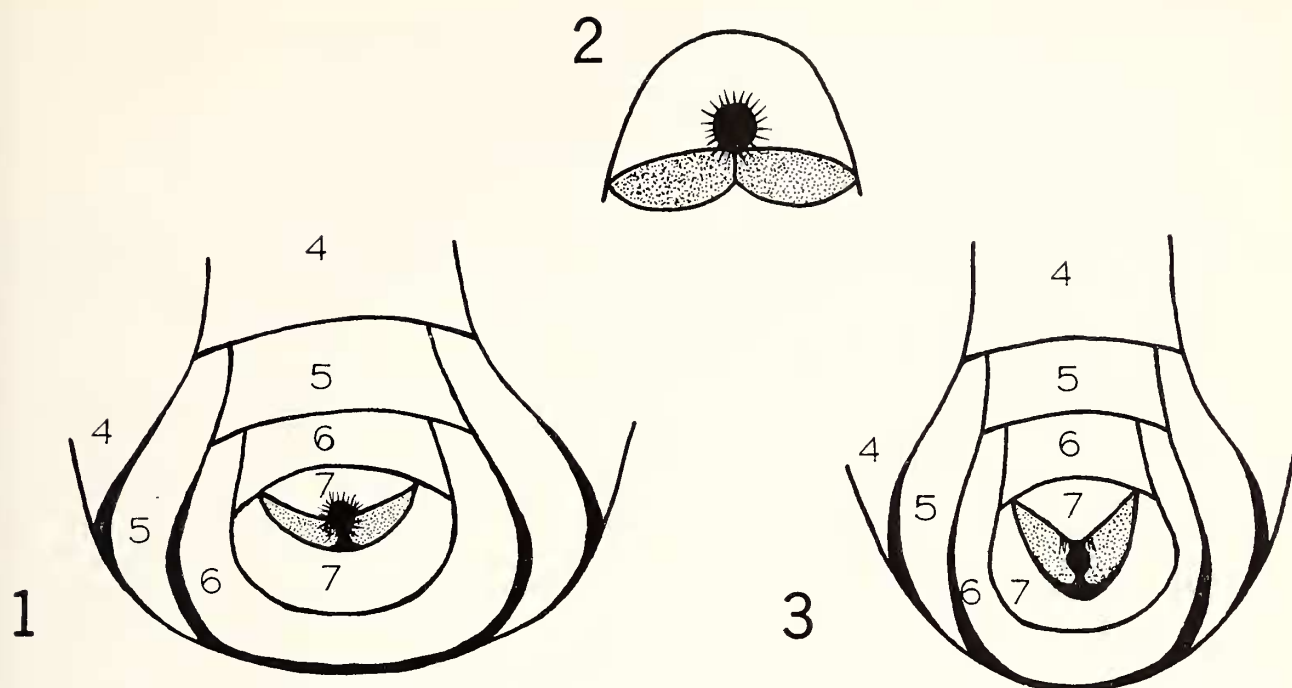
Emery showed that in the Formicinae, the outlet called "cloacal orifice" is in fact the opening of the poison spray duct to the outside, framed in the in-rolled apex of abdominal sternum VII, and that the true anus is situated dorsal to, and separate from, this opening. In order to render discussion easier and more exact, we here introduce the new term *acidopore* for the actual opening of the duct from the poison glands to the outside, as found in Formicinae.

In his paper, Emery showed the acidopore as lying completely within the heavily sclerotized part of the hypopygium (= sternite VII). Our investigation shows that the hypopygium in Formicinae always has thin, flexible, normally concealed extensions of its free lateral edges; we here call these extensions *apicolateral phragmata* (stippled areas in the figures). The phragmata are normally covered by the pygidium (tergum VII) in live specimens of formicine ants examined. We have found that the acidopore, at least in the Camponotini, is partly formed by the phragmata. This is true even of *Camponotus gigas*, the species illustrated by Emery (his figure II). We have redrawn Emery's figure to illustrate the difference in interpretation (Fig. 2).

Usually the hypopygium of formicines projects noticeably from the ventral apex of the gaster, forming a small nozzle-like piece, and the rim of the acidopore is commonly furnished with a funnel-shaped ring or tuft of short, fine setae, situated so as to keep the poison spray directed outward, away from the ant's body. This setal ring is called the *coronula*. Exceptions to this plan occur in tribe Camponotini, which has many species that lack the coronula, and others in which the hypopygium is more or less reduced, or at least not nozzle-like and projecting. In these species, the pygidium (tergite VII) is narrowly rounded at its apex, and may even have a somewhat beak-like free margin; in such cases, the functional acidopore is formed as much by the

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FIGURES 1-3, ventral views of gastric apex of workers of certain camponotine Formicinae to illustrate form of hypopygium and its phragmata as seen when the vent is open; phragmata stippled. FIG. 1, *Polyrhachis pyrrhus* (s-g. *Campomyrma*). FIG. 2, *Camponotus gigas*, hypopygium only, redrawn in reversed position after Emery, 1922. FIG. 3, *Polyrhachis rastellata* (s-g. *Cyrtomyrma*).

pygidium as by the hypopygium, and the outline of the opening remains more or less circular even when the phragmata are covered by the pygidium.

In the extreme of modification, the acidopore is formed virtually entirely within the phragmata, while the body of the hypopygium forms a subtriangular shield with narrowly rounded apex that fits snugly against the free margin of the pygidium in the resting position. Thus, in species with this arrangement (particularly *Polyrhachis* species of the *schang*, *porcata*, *armata* and *rastellata* groups), the gastric apex may appear to have a curved, slit-like orifice when the pygidium and hypopygium are closed together, completely covering the phragmata and contained acidopore. Such specimens can easily be mistaken for Dolichoderinae if other characters are not noted; indeed, misinterpretation of this key character has more than once led to genera being described as new in the wrong subfamily. Of course, if some specimens have the gastric apex open, or are dissected, the phragmata and circular acidopore will be found present in Formicinae, and absent in Dolichoderinae.

We have already mentioned the variable development of the acidopore in the Camponotini. One of us (Hung) has studied this variation in the various groups (erstwhile "subgenera") of genus *Polyrhachis*, and it is summarized as follows:

clypeata group (= s-g. *Campomyrma*). Acidopore formed by body and phragmata of hypopygium; coronula present or absent (worn off?) (Fig. 1).

thrinax group (= s-g. *Myromothrinax*). Acidopore border heavily sclerotized, but without coronula.

schang group (= s-g. *Myramatopa*). Acidopore formed within phragmata; body of hypopygium a narrowly-rounded shield-like platform.

ammon group (= s-g. *Hagiomyrma*), *ornata* group (= smg. *Hedomyrma*), and *guerini* group (= smg. *Chariomyrma*). All have acidopore partly in body of hypopygium and partly in phragmata, but coronula hairs present on body of hypopygium only.

porcata group (= s-g. *Aulacomyrma*), *armata* group (= s-g. *Myrmhopla*), and *rastellata* group (= s-g. *Cyrtomyrma*). As in *schang* group, but with a tuft of hairs on each side of the narrowly-rounded apex of the hypopygial body (Fig. 3).

militaris group (= s-g. *Myrma*), *parabiotica* group (= s-g. *Anoplomyrma*), and *bihamata* group (= s-g. *Polyrhachis*). Acidopore formed in phragmata; tip of body of hypopygium rounded, without hairs.

The situation in the *revoili* group (= *Pseudocyrtomyrma*) remains unknown.

Literature Cited

- BROWN, W. L., JR. 1954. Remarks on the internal phylogeny and subfamily classification of the family Formicidae. *Insectes Sociaux* **1**: 21-31. p. 29.
- BRUES, C. T., A. L. MELANDER AND F. M. CARPENTER. 1954. Classification of Insects. *Bull. Mus. Comp. Zool. Harv.* **108**. p. 640.
- BUREN, W. F. 1944. A list of Iowa ants. *Iowa State Coll. J. Sci.* **18**: 277-312. p. 279.
- EMERY, C. 1922. L'ouverture cloacale des Formicinae ouvrières et femelles. *Bull. Soc. Ent. Belg.* **4**: 62-65.

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